![NM Nanomotion Ltd.]

Application Note NM 6

A Special Series of Low Speed Motors - The LS - for Low Speed High Resolution Applications

The LS motors are ideal for low speeds of less than 1 mm/sec and down to 10 microns/sec, and can maintain very low position error at these velocities. The Low Speed (LS) series of motors consist of three motors, LS-2, LS-4 and LS-8, which were designed specifically for high resolution and low speed applications. These motors were designed for maximum no-load velocity of 20 mm/sec and stall forces of approximately 25% of the standard Nanomotion HR series motors.

The new features offered in the LS series of motors are as follows:

1. New friction pair optimized for requirements of high resolution and low speed.

2. Reduced starting voltage (dead band).

3. Dual phase operation of the finger tips. Each pair of finger tips operates at 180º out of phase.

Each motor within the LS series has its own special AB-1 driver box, with dedicated LC circuits that differs from the LC circuits used with the standard Nanomotion HR series motors. The dedicated AB1 Driver Box limits the output to the motor to a maximum command of 3.5V.Brief specifications for the LS series motors are presented in the table below:

Specification	LS-2	LS-4	LS-8
Maximum allowed velocity [mm/sec]	20	20	20
Stall force [N]	2	4	8
Static Holding force (reference value) [N]	3.5	7	14
Starting command voltage [V] (reference value)	1	1	1
Maximum voltage [V-RMS]	180	180	180

A special conditioning device is an add-on accessory for the LS series of motors. This device (pictured below in Figure 1) consists of a plastic fixture connected to the motor case, and a special cloth that wipes the alumina drive strip just before the motor finger tips travel along the finger tip track. This cloth maintains constant conditions on the friction surface, essential to the stability of high precision systems.

Linear Slide

Conditioning Device

Motor

Figure 1
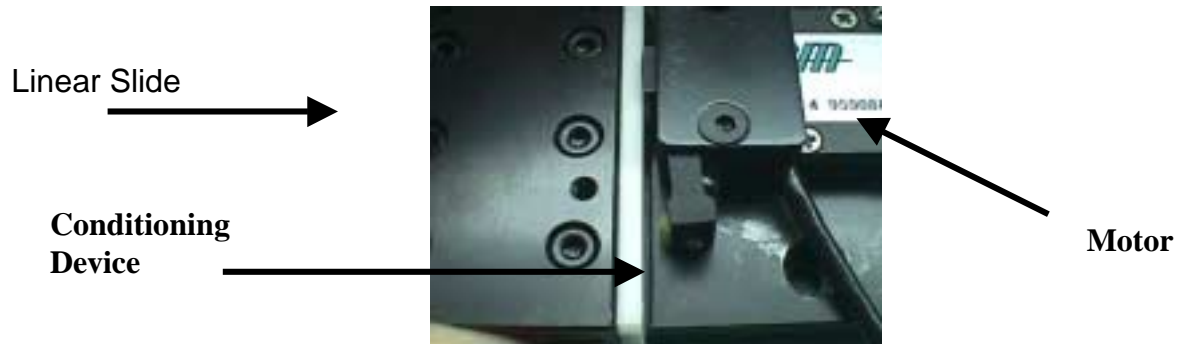
Ceramic Drive Strip

In cases where the customer would like to use their own ceramic prior consultation with the Nanomotion Customer Support Division is strongly recommended.
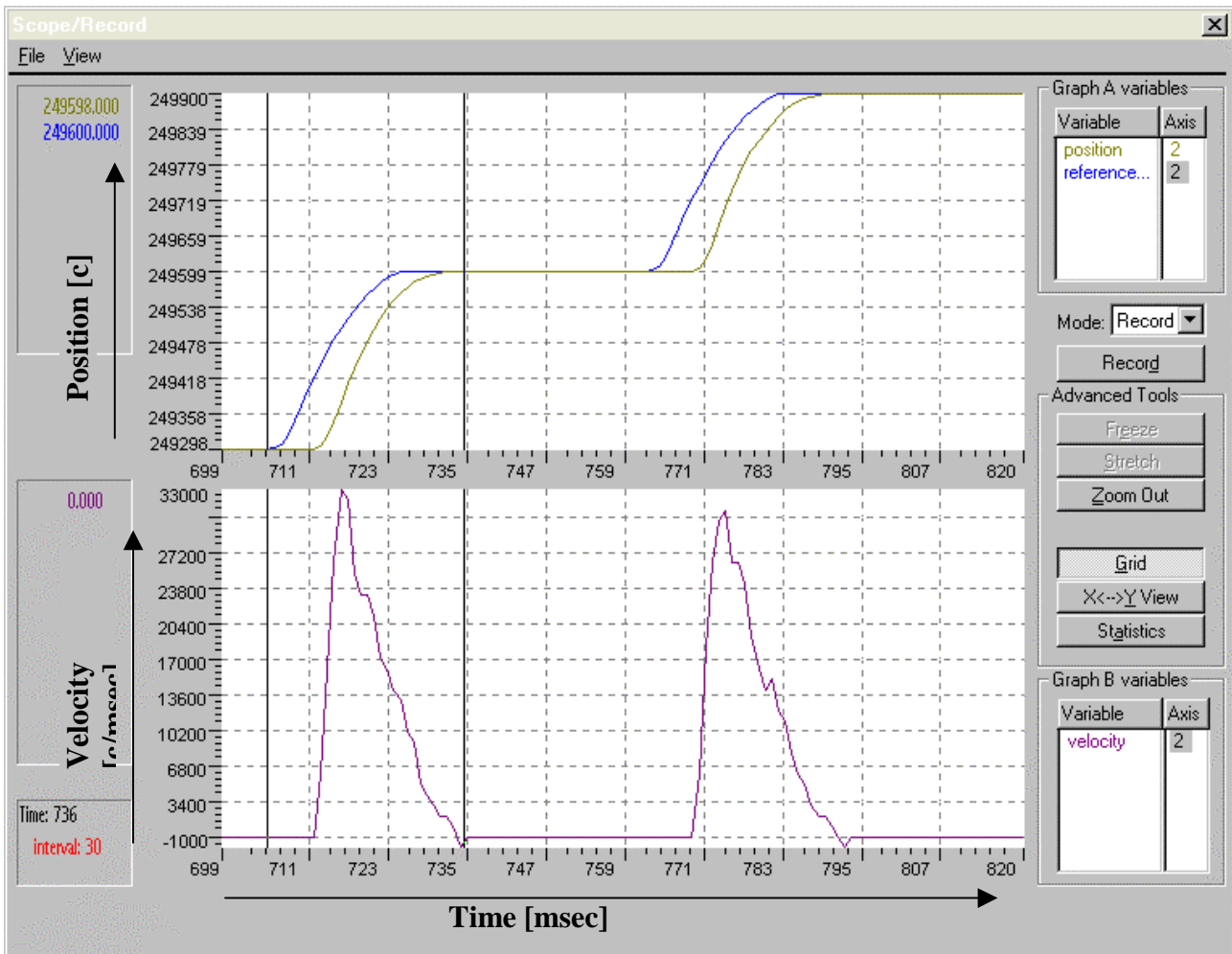
The following plots illustrate typical operations of the LS motors.

Plot 1

30 μm step into ±0.3 μ target radius. The step time is approximately 30 milliseconds.

The upper graph represents the reference position and actual position. The full step and settle time takes 21 msec.
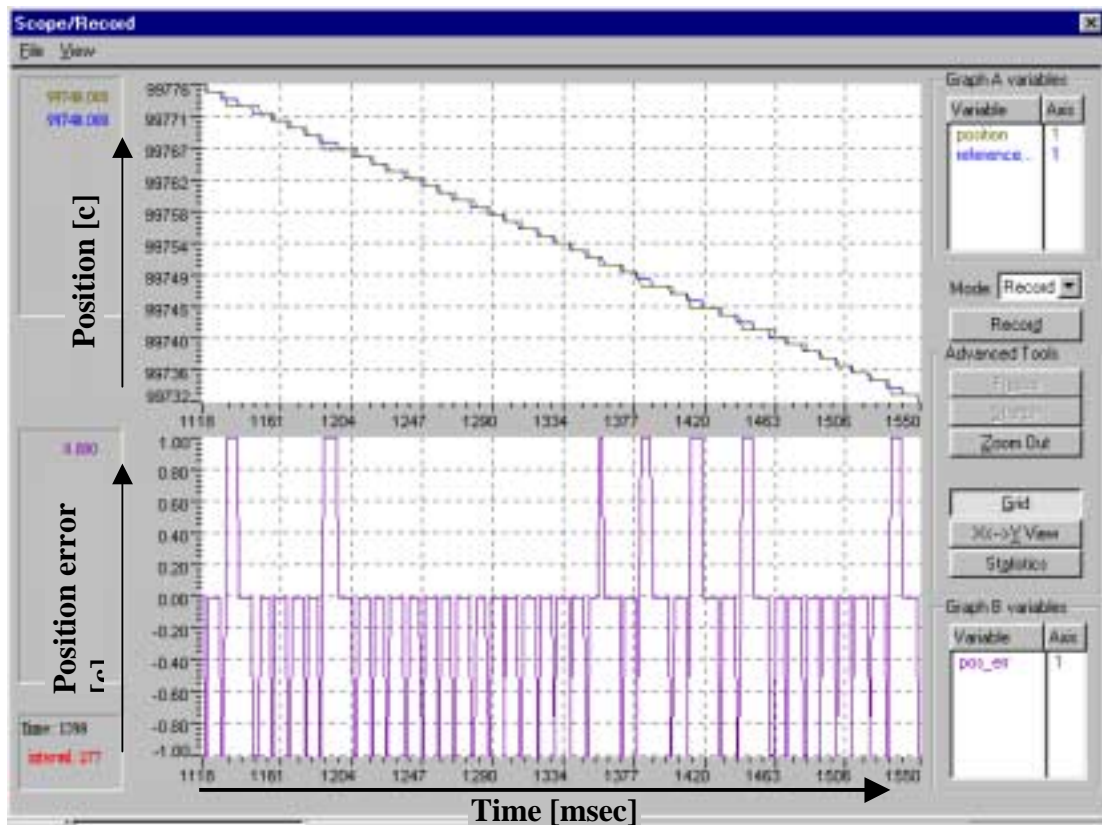
Plot 1

The lower graph represents the actual velocity.
This performance level was logged and monitored consistently for over 450 million steps.

Plot 2

Continuous Motion at Velocity of 10 µ/sec.

The upper graph represents the reference and actual position.

Plot 2

The lower graph represents the position error (counts) of +/- 1 count, using an encoder with a resolution of 0.1 µ. It is expected that with a finer resolution encoder the motion will be smoother.

For further information please consult Nanomotion Customer Support Division.

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